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Abstract

Forty-four Holstein cows were used to measure milk production responses to dryrolled vs processed grain sorghum and expeller vs solvent soybean meal (SBM) in a 2x2 factorial arrangement of four treatments. Processing of grain sorghum decreased feed intake 5%, but increased milk by 3%, protein by 4%, and efficiency by 7%, with fat being unaffected. Replacement of solvent SBM with expeller SBM had little effect on intake, but increased milk by 3%, fat by 5%, and efficiency by 4%, with protein being unaffected. The processing of grain sorghum seems to be a valuable method to improve its nutritive value for lactating cows. Total milk and fat yield, but not protein yield, were increased in response to feeding expeller SBM in the place of solvent SBM.; Dairy Day, 1995, Kansas State University, Manhattan, KS, 1995;

Keywords

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PERFORMANCE OF LACTATING COWS FED PROCESSED GRAIN SORGHUM AND EXPELLER SOYBEAN MEAL

E. C. Titgemeyer and J. E. Shirley

Summary

Forty-four Holstein cows were used to measure milk production responses to dry-rolled vs processed grain sorghum and expeller vs solvent soybean meal (SBM) in a 2×2 factorial arrangement of four treatments. Processing of grain sorghum decreased feed intake 5%, but increased milk by 3%, protein by 4%, and efficiency by 7%, with fat being unaffected. Replacement of solvent SBM with expeller SBM had little effect on intake, but increased milk by 3%, fat by 5%, and efficiency by 4%, with protein being unaffected. The processing of grain sorghum seems to be a valuable method to improve its nutritive value for lactating cows. Total milk and fat yield, but not protein yield, were increased in response to feeding expeller SBM in the place of solvent SBM.

(Key Words: Expeller Soybean Meal, Grain Sorghum, Cows.)

Introduction

Grain sorghum is a feed resource available to many dairy producers in the midwest and is often less expensive than other grains such as corn. Minimally processed grain sorghum (ground or dry-rolled) has a lower energy value than competing grains such as corn and barley, whereas steam-flaked grain sorghum is similar to corn in supporting lactation in dairy cows. Although steam-flaking improves the nutritive value of grain sorghum, the necessary equipment requires a large initial investment. Steam-flaking increases solubility in the rumen and total tract digestibility of the starch component of grain sorghum by gelatinization. An alternative method of starch gelatinization involves heating grain sorghum in a moist environment to at least 156 degrees F then drying to a low moisture suitable for long-term storage. This process can be accomplished with an extruder and a drying oven. Little is known about the effectiveness of this processing method, but the lower initial investment required for its operation may justify its use by dairy production units with access to grain sorghum.

Protein supplementation of dairy cows is becoming increasingly sophisticated. Yet, in many cases, the relationship between protein intake and performance is poorly defined. Processing of soybeans under conditions where heat is generated (i.e., expeller soybean meal) will increase amino acid supply to the dairy animal by making the protein more resistant to degradation in the rumen.

This experiment was conducted to evaluate a new processing method for grain sorghum and to determine if protein needs of dairy cows would be better met by replacing solvent soybean meal (SBM) with expeller SBM.

Procedures

Grain sorghum, purchased from a commercial elevator, was finely ground at the Kansas State University feed mill and transported to the JET-PRO processing facility in Atchison, KS for final processing. Water was added to the ground grain sorghum to achieve a final moisture content of 31%. The wet material was processed through an extruder, then dried at 200 degrees F to a final moisture content of 5%. The resultant product was a pellet with moderate stability during handling.

The expeller SBM was obtained from Delavan Processing, Delavan, KS. The content of undegradable intake protein was increased by exposing the soybeans to heat prior to mechanical extraction of the oil. The

undegradable intake protein value for the resulting SBM approximated 50% compared to 35% for solvent-extracted SBM.

Forty-eight Holstein cows (half primiparous) were allotted by age, milk production, and days in milk to four dietary treatments. Four cows were removed from the experiment because of health problems. Treatments of ground vs pelleted grain sorghum and solvent vs expeller SBM (Table 1) were arranged in a 2×2 factorial. Diets were formulated so the pelleted grain sorghum was substituted directly into diets in place of dry-rolled grain sorghum. Expeller SBM was used as a replacement for solvent SBM. Because the expeller SBM contained a greater amount of residual fat than the solvent SBM (8.5% vs 1.5% of dry matter), diets were balanced to maintain equal levels of lipid by decreasing the amount of supplemental tallow in diets containing expeller SBM. Cows were maintained in tie stalls with ad libitum access to feed that was supplied twice daily as a total mixed ration. Daily weigh backs were obtained immediately prior to the morning feeding. Milk production was measured daily, and weekly milk samples were collected to measure milk composition.

Results and Discussion

Production characteristics of dairy cows fed diets containing either ground or pelleted grain sorghum are shown in Table 2. Dry matter intake was reduced substantially when the pelleted grain sorghum was fed. This was most likely due to the higher energy content and more rapid fermentation of the pelleted product. Milk production tended ($P<.10$) to be increased by the pelleted grain sorghum. However, the fat content of milk was reduced ($P<.05$) by the pelleted grain sorghum and, thus, 3.5% fat-corrected milk (FCM) production was not affected by pelleting. Because pelleting of grain sorghum reduced feed intake without depressing FCM, feed efficiency was improved by 7% when pelleted grain sorghum diets were fed. Total protein yield was increased by pelleting.

Research from the University of Arizona compared steam-flaked grain sorghum to dry-rolled grain sorghum when included in diets for lactating cows. Across their studies, feed intake decreased by 1%, FCM increased by 5%, and efficiency improved by 6% when the grain sorghum was steam-flaked vs dry-rolled. The improvement in efficiency (7%) that we observed after pelleting of grain sorghum was similar to that observed for steam-flaking. This indicates that our processing method may be similar to steam-flaking for improving the nutritive value of grain sorghum.

Production data for cows fed diets containing either solvent or expeller SBM are shown in Table 3. Cows fed diets containing expeller SBM tended ($P<.15$) to produce more total milk and FCM than those fed solvent SBM. Feed intake was not affected by protein source, so the feeding of expeller SBM improved efficiency by slightly more than 4%. Total milk fat yields tended ($P<.15$) to be increased by expeller SBM. This resulted from greater milk yields rather than from a change in fat percentage. Surprisingly, replacing solvent SBM with expeller SBM decreased the percentage protein in milk. However, total milk protein production was not affected by protein source.

In conclusion, processing of grain sorghum improves its nutritive value for lactating cows. The pelleted grain sorghum product that we evaluated caused a 7% improvement in lactation efficiency when added to diets in place of ground grain sorghum. Under our experimental conditions, the replacement of solvent SBM with expeller SBM increased production of milk and fat, but not of protein.

Table 1. Composition of Experimental Diets

	Solvent SBM		Expeller SBM	
Ingredient	Ground GS	Pelleted GS	Ground GS	Pelleted GS
	----------% of dry matter ----------			
Alfalfa	29.6	29.6	29.6	29.6
Grain sorghum, ground	27.2	-	27.2	-
Grain sorghum, pelleted	-	27.2	-	27.2
Soybean meal, solvent	11.4	11.4	-	-
Soybean meal, expeller	-	-	12.1	12.1
Corn silage	10.3	10.3	10.3	10.3
Whole cottonseed	8.8	8.8	8.8	8.8
Soy hulls	6.7	6.7	6.7	6.7
Tallow	1.5	1.5	.8	.8
Molasses	1.0	1.0	1.0	1.0
Minerals/vitamins	3.5	3.5	3.5	3.5

Table 2. Production of Dairy Cows Fed either Ground or Pelleted Grain Sorghum

	Grain sorghum		
Item	Ground	Pelleted	SEM
Dry matter intake, lb/day	57.3	54.7[a]	.5
Milk, lb/day	68.2	70.5[b]	.9
3.5% FCM[1], lb/day	70.6	71.4	1.1
Efficiency, FCM/intake	1.23	1.32[a]	.02
Fat, %	3.73	3.58[a]	.05
Fat, lb/day	2.53	2.52	.05
Protein, %	3.10	3.13	.02
Protein, lb/day	2.11	2.20[a]	.03

[1]Fat-corrected milk.
[a]Different (P<.05) from ground grain sorghum.
[b]Tended (P<.10) to differ from ground grain sorghum.

Table 3. Production of Dairy Cows Fed either Solvent or Expeller Soybean Meal

	Soybean meal		
Item	Solvent	Expeller	SEM
Dry matter intake, lb/day	56.2	55.7	.5
Milk, lb/day	68.4	70.3[a]	.9
3.5% FCM[1], lb/day	69.6	72.4[a]	1.1
Efficiency, FCM/Intake	1.25	1.30[b]	.02
Fat, %	3.62	3.69	.05
Fat, lb/day	2.46	2.58[a]	.05
Protein, %	3.14	3.08[b]	.02
Protein, lb/day	2.16	2.16	.03

[1]Fat-corrected milk.
[a]Tended (P<.15) to differ from solvent soybean meal.
[b]Different (P<.05) from solvent soybean meal.